United States Patent

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[54] **BOOM STOP**
4 Claims, 3 Drawing Figs.

[52] **U.S. Cl.** **212/39**
[51] **Int. Cl.** **B66c 13/48**
[50] **Field of Search** 212/39, 39I, 39MS

[56] **References Cited**

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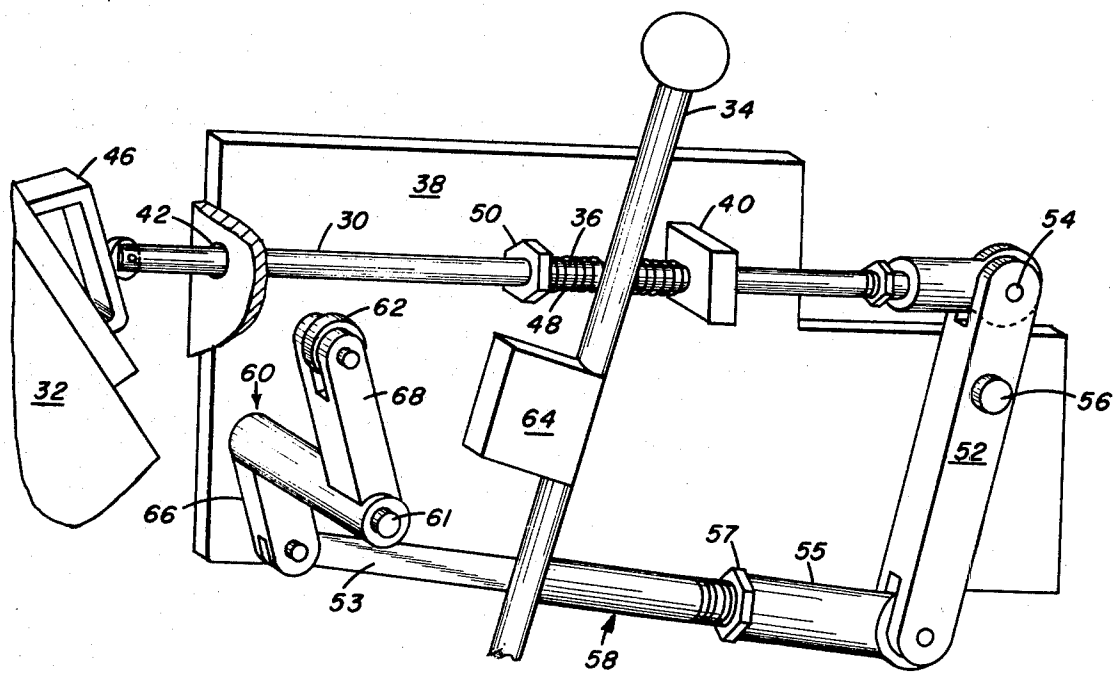
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Primary Examiner—Harvey C. Hornsby
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ABSTRACT: An improved safety device on a crane for preventing the crane boom from falling backward onto the crane cab. A push rod is positioned for engagement with the boom when the boom reaches a substantially vertical elevation. The movement of the rod caused by the upwardly moving boom is multiplied through a system of levers and imparted to a contact lever which pushes the boom control stick into a neutral position thereby stopping the boom before it moves past the maximum safe elevation.



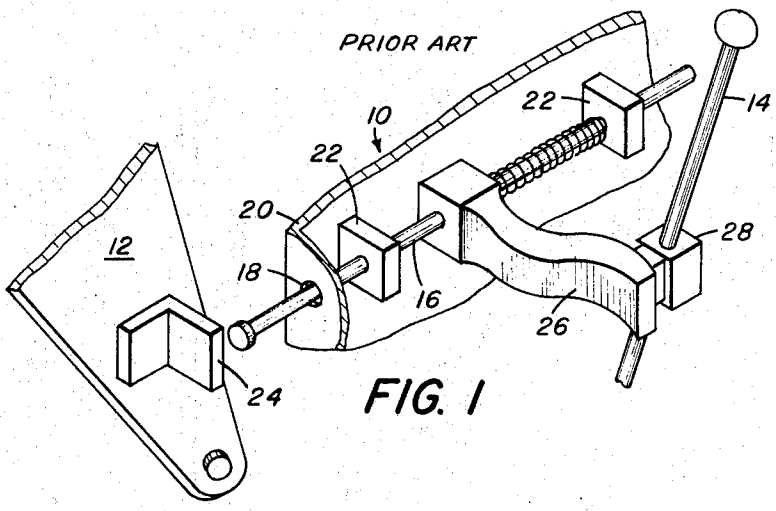


FIG. 1

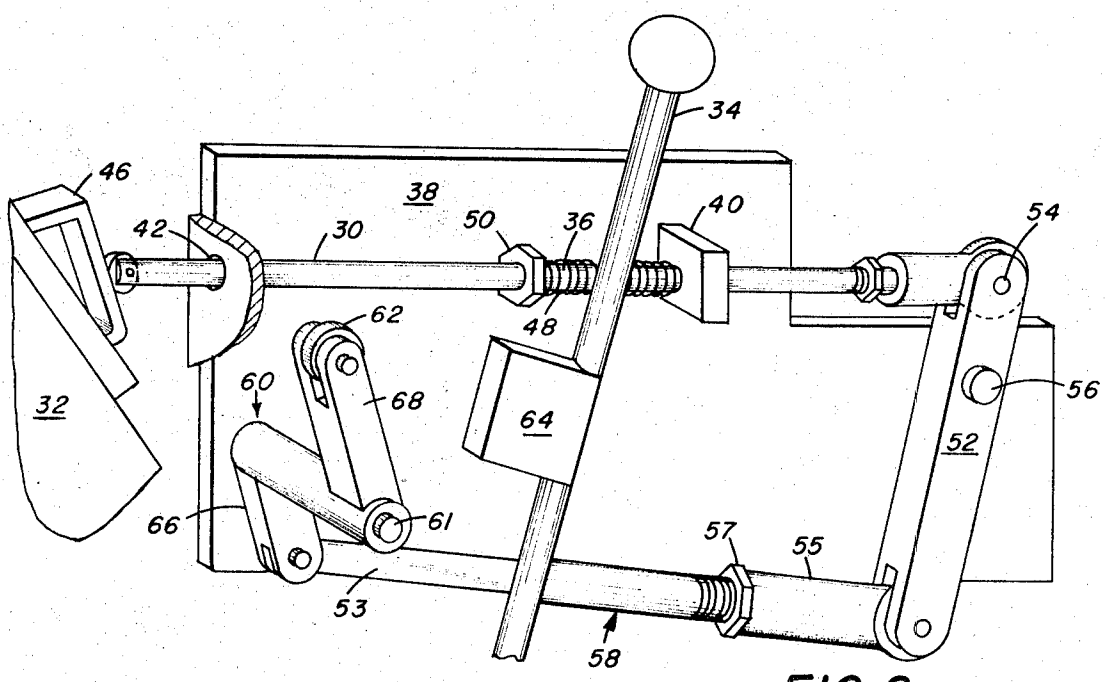


FIG. 2

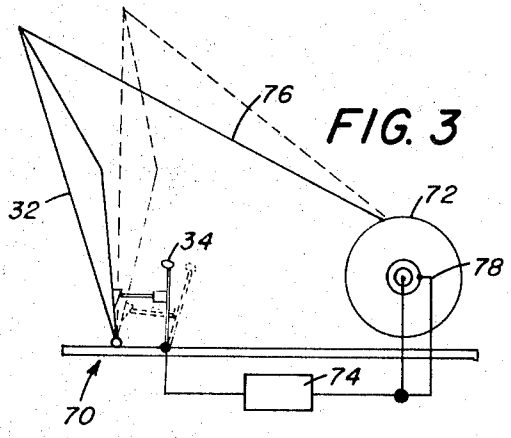


FIG. 3

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BOOM STOP

This invention relates to a safety device on a crane. More particularly, this invention relates to a safety device on a crane for preventing the crane boom from falling backward onto the crane cab.

In a typical boom crane, the boom is pivotally mounted at one end in such a manner that the free end of the boom can be moved in a vertical plane through an arcuate path up or down. Usually the movement of the boom is accomplished by winding or unwinding a cable from a winding drum; the cable being attached adjacent the free end of the boom. When the boom is raised to its maximum safe elevation, which is normally a position perpendicular or near perpendicular to horizontal, there is a danger that the boom might possibly be pulled by the cable past the maximum safe elevation whereupon the boom will fall or crash backwards over the cab causing damage.

Even the most careful crane operator runs the risk on occasion of raising the boom to a point where it could possibly crash over the cab. Because the necessity to raise the boom to its maximum elevation occurs frequently, numerous devices have been developed by the prior art to prevent crane booms from falling backward onto the cab. Generally, these devices are pneumatic, hydraulic or electric systems which have switches positioned near the boom for sensing the position of the boom and which switches are actuated by the boom to appropriately (depending upon the type of system) disengage the winding drum from the power source or actuate a winding drum brake or a cable brake.

Some of the systems developed by the prior art are very sophisticated and complicated and require frequent maintenance to ensure that they function properly. However, in spite of frequent maintenance, many automatic systems are not completely reliable.

In addition to the sophisticated automatic systems developed by the prior art, there have also been attempts to provide simpler mechanical boom stops. Mechanical boom stops provided by the prior art are installed on cranes wherein the boom movement is regulated by a boom control stick mounted in the crane cab. Usually the boom is raised by pushing the boom control stick forward toward the boom and lowered by pulling the stick back toward the operator. A typical mechanical boom stop is a device actuated by the upward movement of a boom to push the boom control stick back to a neutral position, thereby disengaging the winding drum and stopping the upward movement of the boom. A mechanical boom stop as provided by the prior art is shown in FIG. 1 (described below). The mechanical boom stops designed in the past have been ineffective because they are not as sensitive and responsive to boom movement as is necessary for a positive reliable safety device.

SUMMARY OF THE INVENTION

The present invention is embodied in a simple mechanical safety device which is reliable and is directly responsive to the movement of a boom. The present invention is particularly applicable to a crane having a boom and means for raising and lowering the boom in response to the movement of a boom control stick. The present invention operates under a principle of mechanically multiplying the distance of movement of a push rod through a pivotally mounted lever while transferring that multiplied movement to contact lever to contact the boom stick. According to the present invention, a slight movement of the push rod caused by the push rod being moved by a boom results in a proportionately larger movement of a contact lever to ensure a quick direct movement of the contact lever to engage the boom control stick and move the boom control stick to a predetermined neutral position where it stops the boom movement.

In one embodiment of the present invention there is a push rod positioned for engagement with the boom when the boom reaches a predetermined elevation. A contact lever is pivotally mounted for engagement with the boom control stick. Lever means are provided responsive to the movement of the push rod for multiplying the distance of movement of the push rod and imparting the multiplied movement to the contact lever whereby the contact lever quickly and positively engages the boom control stick to move it to a predetermined neutral position where the boom is stopped.

In another aspect of the invention there is a push rod mounted for engagement at one end with a boom and movable when pushed by the boom. A pivot lever movable in response to the movement of the push rod is connected to the opposite end of the push rod. A contact lever is mounted for engagement with a boom control stick. The contact lever is connected by means of a connecting rod to the pivot lever making the contact lever responsive to the boom movement. The pivot lever is pivoted such that the movement imparted to the end of the lever connected to the push rod is multiplied, and the multiplied movement is imparted through the connecting rod to the contact lever resulting in a highly responsive boom safety device. A small movement of the boom imparted to the push rod results in a larger movement imparted to the contact lever and better assures quick movement of the boom control stick to the position where boom movement is stopped.

The various features of novelty which characterize the invention are pointed out with particularity in the claims annexed to and forming a part of the specification. For a better understanding of the invention, the operating advantages and the objectives obtained by its use, reference should be had to the accompanying drawings and descriptive matter in which a preferred embodiment of the invention has been illustrated.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view partially cut away of a safety device known in the prior art.

FIG. 2 is a perspective view partially cut away of a safety device according to the present invention.

FIG. 3 is a partial schematic view of a crane.

DESCRIPTION OF FIG. 1

Referring to FIG. 1, there is shown a mechanical boom stop provided by the prior art. The boom stop **10** is mounted in a crane cab between the boom **12** and the boom control stick **14**. A push rod **16** protrudes through a hole **18** in the front cab wall **20**. A pair of brackets **22** are mounted from the cab wall to support the rod **16**. When the boom **12** is elevated in the direction indicated by the arrow, a bracket **24** on the boom engages the push rod **16** and pushes it toward the boom control stick **14**. An arm **26** extending from the push rod engages a pad **28** on the boom control stick **14** and moves the stick **14** back until it reaches a position where the winding drum is declutched and a drum brake or cable brake is actuated. It can be seen from the FIG. that under certain conditions the boom must move through several degrees of elevation from the time it contacts the push rod **16** until the arm **26** engages the pad **28** on the boom control stick **14**. Furthermore, the boom **12** must continue to move until it has pushed the stick **14** to a position where the winding drum is declutched or the drum braked to stop the upward movement of the boom.

DESCRIPTION OF THE PREFERRED EMBODIMENT

FIG. 2 shows the preferred embodiment of the present invention. The boom stop **30** of the present invention is mounted in a crane cab between the boom **32** and the boom control stick **34**. A push rod **36** is mounted on a platform **38** (or against the cab wall) by means of a support block **40**. The push rod **36** protrudes through a hole **42** in the front wall **44** of the crane cab and is positioned for engagement with a bracket **46** on the boom **32**. The push rod is held in a bias position by a spring **48** which is located between the support block **40** and a collar **50**. A pivot lever **52** is mounted from its upper or first end to the push rod **36** by means of a pin **54**. The pivot lever **52** is pivotally mounted from the platform by a pin **56**.

A connecting rod **58** connects the lower or second end of the pivot lever **52** to the lower arm **66** of the contact lever **60**.

The contact lever 60 is also pivotally mounted on a stub shaft 61 protruding from the platform. The shaft is positioned relative to the lever such that the shaft is closer to the lower or first end 66 than the upper or second end 68. A contact roller 62 is fitted into the bifurcated end portion of the upper arm 68 of the contact lever 60 and is suitably held in position by a pin. A contact plate 64 is positioned on the boom control stick 34 for engagement by the contact roller 62.

When the boom 32 is elevated, the bracket 46 contacts the end of the push rod 36. The movement of the push rod 32 against the upper end of the pivot lever 52 causes the pivot lever to pivot around the pin 56. The motion of the pivot lever is transmitted through the connecting rod 58 to the contact lever 60. The contact lever 60 pivots around the shaft 61 until the contact roller 62 engages the contact plate 64 on the stick 34 and pushes the stick 34 into the position where the winding drum is braked, disengaged or the boom movement is otherwise stopped.

The reason the boom stop of the present invention reacts quickly and is more responsive to boom movement is due to the position of the pivot pin 56 relative to the pivot lever 52. By positioning the pivot pin 56 closer to the upper end of the lever 52 than to the lower end, the distance the lower end travels is greater than the distance travelled by the upper end. Therefore, any given movement of the boom imparted through the push rod to the lever 52 is multiplied as the lever pivots around the pin, thereby increasing the sensitivity and responsiveness of the boom stop. It has been found with a boom stop in which the present invention is embodied that the boom can be stopped within one degree of boom travel from the position where the boom contacts the push rod.

Additional response is gained as shown in FIG. 2 by having the contact lever pivotally mounted so that the stub 61 is closer to the lower arm 66 than the upper arm 68. The upper arm will therefore travel a greater distance than the lower arm. Accordingly, it can be seen that the sensitivity of a boom stop in which the present invention is embodied can be controlled by changing the pivot points 56 and 61 relative to the ends of the pivot lever and contact lever respectively.

The sensitivity of the boom stop can also be varied by adjusting the length of the connecting rod 58. As shown in FIG. 2, the rod can be fabricated so that its length is variable. The threaded male end 53 is threaded into a corresponding female end 55. A lock nut 57 is provided to hold the rod at the desired length. Accordingly, the longer the length of the rod, the closer the upper arm 68 of the contact lever 60 is positioned to the boom control stick 34 and the quicker the contact lever engages the boom stick.

FIG. 3 shows a schematic of a crane 70 having a winding winch 72 for changing the elevation of the boom 32 and a boom control stick 34 for controlling the movement of the boom through a control and drive mechanism 74 of commercially available design. The boom is elevated when the boom control stick 34 is moved toward the boom 32 and the mechanism 34 actuates the winding drum to wind up the cable 76 connected to the boom. As the boom approaches a predetermined elevation shown in phantom, the boom moves the boom stick to the predetermined location (neutral position) also indicated in phantom whereupon the winch is disengaged from the mechanism 74 and a drum brake 78 also of commercial design is actuated by the mechanism to engage the drum shaft and completely stop the upward movement of the boom. The boom is lowered by the operator pulling the boom control stick back.

Once the concepts of the present invention have been understood by one skilled in the art, it would be relatively a simple matter to adapt the present invention to a crane where the boom is elevated by pulling the boom control stick back instead of pushing it forward as described herein.

The invention has been described in detail with particular reference to a preferred embodiment thereof, but it will be understood that variations and modifications can be effected within the spirit and scope of the invention.

We claim:

1. In a crane having a boom and means for elevating said boom in response to the movement of a boom control stick, an improved device for stopping the elevating of said boom by moving said boom control stick to a predetermined position where said boom movement is stopped, said device comprising:

a movable push rod positioned for engagement with and movement by said boom when said boom reaches a predetermined elevation;

a contact lever pivotally mounted for engagement with said boom control stick to effect movement of the boom control stick to a position where boom movement is stopped; and

lever means responsive to the movement of the push rod for multiplying the distance of movement of said push rod and for imparting said movement of said push rod to said contact lever whereby said contact lever engages the boom control stick to move said boom control stick to a predetermined position where boom movement is stopped.

2. The invention according to claim 1 wherein said lever means comprises:

a pivotally mounted pivot lever having a first and a second end;

a connecting rod connected to said second end of said pivot lever and said contact lever;

said pivot lever connected at its first end to said push rod and pivoted at a point closer to said first end than said second end so that movement of said push rod causes said second end of said pivot lever to move a greater distance than said first end of said pivot lever.

3. The invention according to claim 2 wherein said contact lever has a first end and a second end and is pivoted at a point closer to said first end than said second end.

4. The invention according to claim 2 wherein the length of said connecting rod is adjustable.